

# Claims

- [c1] An accumulation conveyor system, comprising:  
an accumulation assembly adapted to accumulating a plurality of articles into a slug of articles, the slug of articles having a nominal length;  
a transport line comprising a plurality of tandem transport conveyors downstream of said accumulation assembly; and  
a control for said accumulation assembly and said transport line, said control discharging individual slugs from said accumulation assembly and transporting the slugs from said accumulation assembly with said transport conveyors, said control monitoring slugs at said transport conveyors and accumulating slugs with said transport conveyors.
- [c2] The accumulation conveyor system of claim 1 wherein said transport conveyors have lengths substantially equal to said nominal length.
- [c3] The accumulation conveyor system of claim 1 wherein said accumulation assembly accumulates articles with gaps between the articles.

- [c4] The accumulation conveyor system of claim 1 wherein said accumulation assembly accumulates articles substantially without gaps between the articles.
- [c5] The accumulation conveyor system of claim 1 wherein said control accumulates slugs at the transport line from downstream transport conveyors to upstream transport conveyors.
- [c6] The accumulation conveyor system of claim 5 wherein said transport conveyors accumulate slugs at a first speed and discharge accumulated slugs at a second speed that is higher than said first speed.
- [c7] The accumulation conveyor system of claim 1 wherein said accumulation assembly comprises a plurality of conveying sections defining tandem accumulation zones and wherein said control operates said conveying sections to accumulate articles in said zones and form a slug by reducing gaps between articles in sequence from upstream gaps to downstream gaps.
- [c8] The accumulation conveyor system of claim 1 wherein said accumulation assembly comprises a slug forming section and a slug combining section, said slug forming section forms slug portions and discharges slug portions to said slug combining section, said slug combining sec-

tion combines slug portions into slugs.

- [c9] The accumulation conveyor system of claim 8 wherein said slug accumulation section comprises a plurality of conveying sections defining tandem accumulation zones and wherein said control operates said conveying sections to accumulate articles in said zones and form a slug by reducing gaps between articles in sequence from upstream gaps to downstream gaps.
- [c10] The accumulation conveyor system of claim 1 including at least two of said accumulation assemblies and at least two of said transport lines, each downstream of a respective one of said at least two accumulation assemblies, said system further including a merge for merging slugs from said transport lines and a downstream process downstream of said merge.
- [c11] The accumulation conveyor system of claim 10 wherein said downstream process comprises an article sortation process.
- [c12] An accumulation conveyor apparatus, comprising:
  - a conveying surface divided into a plurality of conveying sections, said conveying sections defining tandem accumulation zones;
  - a control, said control monitoring articles on said con-

veying surface and operating said conveying sections to accumulate articles in said zones, said control operating said conveying sections with articles accumulated in said zones to form a slug by reducing gaps between articles.

- [c13] The apparatus of claim 12 wherein said control starts and stops individual ones of said conveying sections no more than once during an accumulation cycle.
- [c14] The apparatus of claim 12 wherein said control forms the slug concurrently with discharging articles from said conveying surface.
- [c15] The apparatus of claim 12 including a slug combining section downstream of said conveying surface to combine slugs into larger slugs.
- [c16] The apparatus of claim 12 further including a transport line comprising a plurality of tandem transport conveyors downstream of said accumulation assembly, wherein said control discharges individual slugs from said accumulation assembly and transports the slugs from said accumulation assembly with said transport conveyors, said control monitoring slugs at said transport conveyors and accumulates slugs with said transport conveyors.
- [c17] The accumulation conveyor apparatus of claim 12 wherein said accumulation assembly forms a slug by re-

ducing gaps between articles in sequence from upstream gaps to downstream gaps.

[c18] The accumulation conveyor apparatus of claim 12 including at least two of said conveying surfaces, said apparatus further including a merge for merging slugs from said conveying surfaces and a downstream process downstream of said merge.

[c19] The accumulation conveyor system of claim 18 wherein said downstream process comprises an article sortation process.

[c20] An accumulation conveyor apparatus, comprising:  
a conveying surface divided into a plurality of conveying sections, said conveying sections defining tandem accumulation zones;  
a control, said control monitoring articles on said conveying surface and operating said conveying sections to accumulate articles in said zones, said control operating said conveying sections to form a slug by reducing gaps between articles in sequence from upstream gaps to downstream gaps.

[c21] The apparatus of claim 20 wherein said control starts and stops individual ones of said conveying sections no more than once during an accumulation cycle.

- [c22] The apparatus of claim 20 wherein said control forms said slug concurrently with discharging articles from said conveying surface.
- [c23] The apparatus of claim 20 including a slug combining section downstream of said conveying surface to combine slugs into larger slugs.
- [c24] The apparatus of claim 20 further including a transport line comprising a plurality of tandem transport conveyors downstream of said accumulation assembly, wherein said control discharges individual slugs from said accumulation assembly and transports the slugs from said accumulation assembly with said transport conveyors, said control monitoring slugs at said transport conveyors and accumulates slugs with said transport conveyors.
- [c25] The apparatus of claim 20 including at least two of said conveying surfaces, said apparatus further including a merge for merging slugs from said conveying surfaces and a downstream process downstream of said merge.
- [c26] The accumulation conveyor system of claim 25 wherein said downstream process comprises an article sortation process.
- [c27] An accumulation conveyor apparatus, comprising:

a conveying surface divided into a plurality of conveying sections, said conveying sections defining tandem accumulation zones;

article sensors associated with said conveying sections and wherein said article sensors are positioned at interfaces of said conveying sections;

a control, said control monitoring articles on said conveying surface and operating said conveying sections to accumulate articles in said zones by terminating operation of a conveying section when the associated article sensor senses a trailing portion of an article at that conveying section;

said control operating said conveying sections with articles accumulated in said zones to form a slug by reducing gaps between articles.

[c28] The apparatus of claim 27 wherein said control operates said conveying sections to discharge articles by initiating operation of a conveying section when an associated article sensor senses a leading portion of an article upstream of that conveying section.

[c29] The apparatus of claim 27 wherein said control operates said conveying sections during a discharge mode by initiating operation of a conveying section when an associated article sensor senses a leading portion of an article upstream of that conveying section.

- [c30] The apparatus of claim 27 wherein said control discharges articles in said discharge mode with gaps between the articles.
- [c31] The apparatus of claim 27 including a slug combining section downstream of said conveying surface to combine slugs into larger slugs.
- [c32] The apparatus of claim 27 further including a transport line comprising a plurality of tandem transport conveyors downstream of said accumulation assembly, wherein said control discharges individual slugs from said accumulation assembly and transports the slugs from said accumulation assembly with said transport conveyors, said control monitoring slugs at said transport conveyors and accumulates slugs with said transport conveyors.
- [c33] The accumulation conveyor apparatus of claim 27 wherein said accumulation assembly forms a slug by reducing gaps between articles in sequence from upstream gaps to downstream gaps.
- [c34] The accumulation conveyor apparatus of claim 27 including at least two of said conveying surfaces, said apparatus further including a merge for merging slugs from said conveying surfaces and a downstream process downstream of said merge.



- [c35] The accumulation conveyor system of claim 34 wherein said downstream process comprises an article sortation process.
- [c36] A method of accumulating articles, comprising:  
providing an accumulation assembly and accumulating a plurality of articles with said accumulation assembly into a slug of articles, the slug of articles having a nominal length;  
providing a transport line comprising a plurality of tandem transport conveyors downstream of said accumulation assembly;  
discharging individual slugs from said accumulation assembly and transporting the slugs from said accumulation assembly with said transport conveyors, including monitoring slugs at said transport conveyors and accumulating slugs with said transport conveyors.
- [c37] A method of accumulating articles, comprising:  
providing a conveying surface divided into a plurality of conveying sections, said conveying sections defining tandem accumulation zones;  
operating said conveying sections to accumulate articles in said zones;  
operating said conveying sections with articles accumulated in said zones thereby forming a slug by reducing

gaps between articles.

[c38] A method of accumulating articles, comprising:  
providing a conveying surface divided into a plurality of conveying sections, said conveying sections defining tandem accumulation zones;  
monitoring articles on said conveying surface and operating said conveying sections to accumulate articles in said zones;  
forming a slug by reducing gaps between articles in sequence from upstream gaps to downstream gaps.

[c39] A method of accumulating articles, comprising:  
providing a conveying surface divided into a plurality of conveying sections, said conveying sections defining tandem accumulation zones;  
sensing articles at interfaces of said conveying sections;  
operating said conveying sections to accumulate articles in said zones;  
operating said conveying sections with articles accumulated in said zones thereby forming a slug by reducing gaps between articles;  
operating said conveying sections to accumulate articles comprises terminating operation of a conveying section when a trailing portion of an article is sensed at that conveying section.